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CS 317-01: Applications of Numerical Methods

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CS/MTH 317/517 Applications of Numerical Methods for Computational Science

Section I – Winter 2012 Tu & Th 4:10 – 5:25 p.m., Russ Center Room 145
Last Updated: January 2, 2012

Description: Applications of computing for solving scientific and engineering problems. Numerical solution of initial value and boundary value problems for ordinary and partial differential equations are covered. Applications involving numerical optimization methods are included. Special topics presented as schedule permits. Four quarter credit hours: lecture.

Prerequisites: Mathematics courses recommended: MTH 231 (Calculus III) and [MTH 235 (Differential Equations with Matrix Algebra) or MTH 253 (Elementary Matrix Algebra)]. Programming course prerequisites: CEG 220 (C Programming) or CS 241 (Computer Programming II – CS majors) or CS 142 (Computer Programming II – non-CS majors).

Instructor: Dr. Ronald F. Taylor, RC 340, 775-5122, ronald.taylor@wright.edu, office hours: 2:00 – 4:00 p.m. on Tuesday and Thursday (other times by appointment).

Required Textbook:

Numerical Computing with MATLAB, Cleve B. Moler, Society for Industrial and Applied Mathematics (SIAM), 2004, ISBN 978-0-898716-60-3. Free online copy and software at: http://www.mathworks.com/moler/index_ncm.html

Suggested Resources:

Numerical Mathematics and Computing, Sixth Edition, W. Cheney and D. Kincaid, Thomson Brooks/Cole, 2008, ISBN 13: 978-0-495-11475-8.

Scientific Computing with Case Studies, Dianne P. O'Leary, Society for Industrial and Applied Mathematics (SIAM), 2009, ISBN 978-0-898716-66-5.

Course Home Page and Pilot: <http://www.cs.wright.edu/people/faculty/rtaylor/cs317wi12> available by the start of second week of class. We may be using Pilot for posting of grades and submittal of some assignments or portions of assignments. Students should familiarize themselves with accessing Pilot. Students are also responsible for accessing the Course Home Page or Pilot for printing copies of resource materials as needed. Some handouts may be given in class.

Programming: MATLAB Student Edition http://www.mathworks.com/academia/student_version/ from MathWorks (about \$100). Wright State University's College of Engineering and Computer Science provides a special licensing program for the MathWorks MATLAB software. More information at <http://www.wright.edu/software/mathworks/>. Students may also use Octave which is free <http://www.gnu.org/software/octave/download.html>. When we refer to "MATLAB" students may also substitute "Octave". Programming assignments mostly will require MATLAB which is available on a number of Wright State systems. Writing and using numerical programs is an important part of this course. It is expected that students will spend a minimum of 2 hours per week working in a computer lab or equivalent environment enhancing their programming skills and completing programming assignments for this course. We may also use C/C++ programming for some class demonstrations. Some assignments may involve using or adapting some given programs. Get help from the instructor if you have questions or concerns about installing/learning MATLAB or C/C++.

Computers and Computing Accounts: You must be able to access the Web and have a WSU Student Login to Wings, e-mail, and Pilot. Check your WSU e-mail on a regular basis for any course announcements from the instructor. Get familiar with the use of the PCs in Russ Center 152C to access MATLAB if you do not have it on your own PC. Needed computing topics be covered in class and handouts or web citations given as appropriate. Check the University computing information at <http://www.wright.edu/cats/studentzone>.

Use of E-Mail: All registered students have access to a Wright State e-mail account. The Instructor will use only that e-mail account to initiate communication with student. The Instructor will reply to other e-mail accounts. **IMPORTANT:** Please include in any communication with Instructor, a Subject which starts with "CS317" (or CS517, MTH317, MTH517). For example, a student with a question about HW 1, would use as a Subject: "CS317: Question on HW 1 Problem 2."

Grading Policy: Mid-term exam and quizzes – 35%. One comprehensive final – 40%. Homework/Project assignments – 25%. Quizzes may be in class, take-home, or in-office Q&A: points included with mid-term score. Quiz point values may vary. Students registered at the graduate level (i.e. CS 517 or MTH 517) will be required to complete extra problems, programs and/or special projects as part of the Homework/Project component of this course. Expect about six major

Homework/Project assignments. A number of problems assigned may be considered "practice" and will not be graded. In general, one week will be given to prepare these assignments. Smaller homework problems/investigations may be due the next class period. Follow the "Homework Standards" posted on the course website. **IMPORTANT:** Submit any specified program files to be graded via Pilot only -- materials sent by e-mail will not be graded. Course Grade Based on Average:

A: 100-90, B: less than 90-80, C: less than 80-70, D: less than 70-60, F: less than 60-0.

Class Policies: No late or early exams unless verifiable emergency. No make-up quizzes: quizzes may be unannounced. Attendance at lecture is not a component of your grade. However, students are expected to attend all lectures and to participate in class discussion. Attendance may be taken in the course to better get to know students. In cases of infrequent attendance, lower homework and exam grades will inevitably result since a significant portion of lecture material is not covered in the text. All Homework/Project assignments are due at the start of class and/or in Pilot on the date and time specified. Grades on late assignments will be reduced by 10%. Submittals more than one day late will not be graded - "zero" grade assigned. Exceptions to the above policies may be made unusual circumstances when documentation is provided in writing -- otherwise expect strict enforcement of the policies. All work submitted must be your own unless group assignments are explicitly made by the Instructor; sharing of program code or copying problem solutions/codes from any source will result in at least a homework grade of "zero" for all involved and possibly a grade of "F" for the course. University procedures for plagiarism will be strictly followed. Sharing ideas and general mathematical and computer skills with others outside of class is encouraged. Students are expected to read, understand and follow the University Academic Integrity Policy at:

<http://www.wright.edu/students/judicial/integrity.html>

Supplemental Class Information and Homework Standards: A document: "Supplemental Information" is given on the class website which clarifies and details how the above class and grading policies are to be implemented. Also carefully study and follow the "Homework Standards" document also on the website. Students are responsible for understanding these documents referring to them during the quarter as needed. Please ask for clarification if you have questions about either document.

Schedule: Topics may vary. Exams dates and times are firm. "Chapter" is the Required Textbook

Week	Topics	Reference (Moler Chapter)
1	Introduction, Review of Numerical Methods , Mathematics and Programming	Lecture Notes
2	Linear Systems of Equations and Eigenproblems for Differential Equations	Chap 2 and 10
3	Applications of Ordinary Differential Equations (ODEs)	Chap 7 and 10
4	Initial Value Problems for ODEs: Single step methods	Chapter 7 and Lecture Notes
5	Initial Value Problems for ODEs: Multistep methods (Exam Thursday February 2nd)	Chapter 7 and Lecture Notes
6	Boundary Value Problems for ODEs and applications	Chapter 7 and Lecture Notes
7	Partial Differential Equations (PDEs) and applications	Chapter 11 and Lecture Notes
8	PDEs and applications (concluded)	Chapter 11 and Lecture Notes
9	Fourier Analysis	Chapter 8
10	Introduction to Simulation and Optimization (as time permits)	Chapter 9 and Lecture Notes
	Comprehensive Final (Tuesday March 13 th 5:45-7:45 p.m. in usual classroom)	